



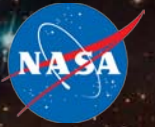
A New Space Enterprise- Exploration Technology and Capability Development

2010 Presidential Space Conference

**Mr. Douglas Cooke
Associate Administrator
Exploration Systems Mission Directorate**

April 15, 2010

Strategy for Future Human Missions



Potential Destinations



Common Capabilities



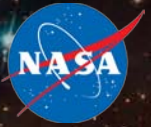
Technology Building Blocks

Efficient In-Space
Aerocapture
Low-cost Engines
Cryo Fluid
Robust/Efficient
Lightweight
Radiation Research
Zero/Low-g Research
Regenerable Life
Advanced
Lightweight EVA

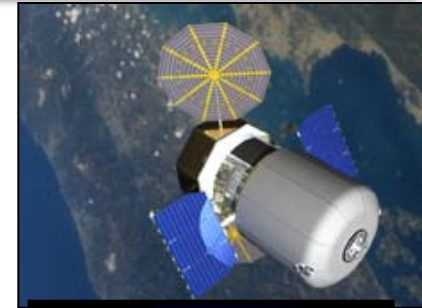
"Breakthrough" Technologies

Hypersonic Inflatable
aerocapture
Regenerative
Application
Revolutionary ETO
Pockets
Innovative Mission
Concepts

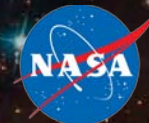
Exploration Research and Technology Development



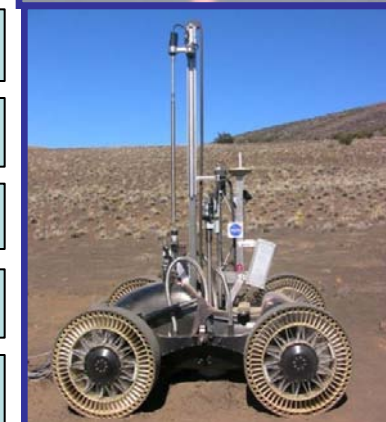
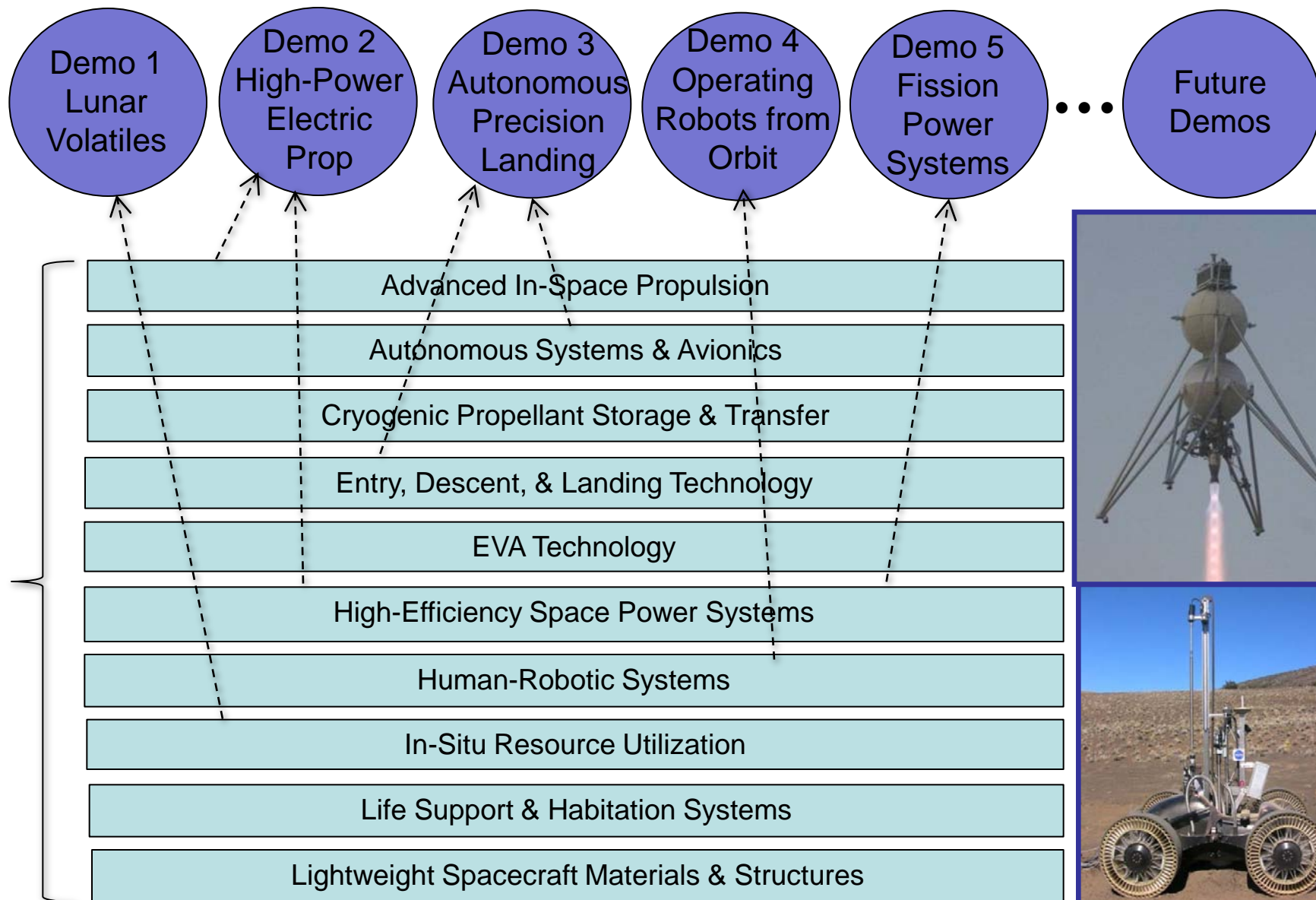
- **Exploration Technology and Demonstrations**
 - Flagship Technology Demonstration Program
 - Enabling Technology Development and Demonstration Program
- **Heavy-Lift and Propulsion Technology**
 - First Stage Engine Research and Development
 - In-space engine demonstrations
 - Foundational Propulsion Research
- **Exploration Precursor Robotic Missions**
 - Medium Exploration Class Missions
 - Small Exploration Scout Missions
 - Missions of Opportunity
- **Human Research Program increased funding**



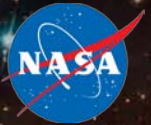
Exploration Technology Development and Demonstration Approach



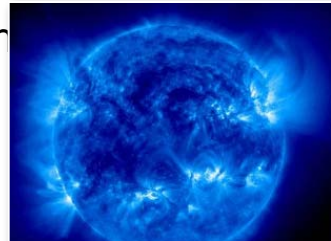
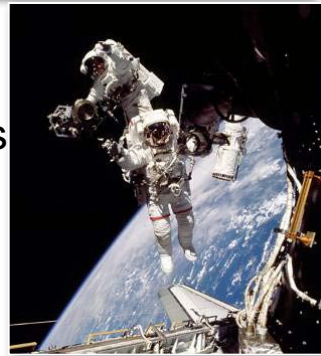
Demo Projects Demo Projects
Foundational Technology Domains



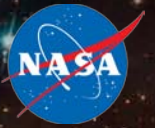
Human Research Program Augmentation Summary



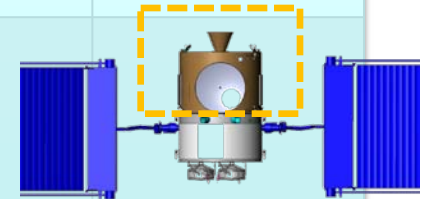
- **Biomedical technologies** investment increased
 - Solutions to problems of human spaceflight with potential Earth applications
 - Space Station as a test bed for advanced medical care
- **Space radiation research** investment increased
 - Increases critical research to reduce uncertainty of radiation risks
 - Coordination with shielding and protection technology demonstrations
- **Behavioral Health Research** investment increased
 - Related to behavioral factors and physiological implications of long-duration missions.
- **Space Station utilization** investment increased
 - New human health related technology demonstrations
 - Additional research addressing human risks during long-duration exposure to microgravity
 - New research projects to be solicited via research announcements
- **STEM education** investment increased
 - Involve larger numbers of students, teachers, and general public in ongoing projects
- **National Space Biological Research Institute** investment increased



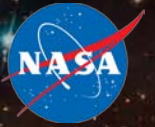
Flagship Technology Mission-Candidate Technology Content



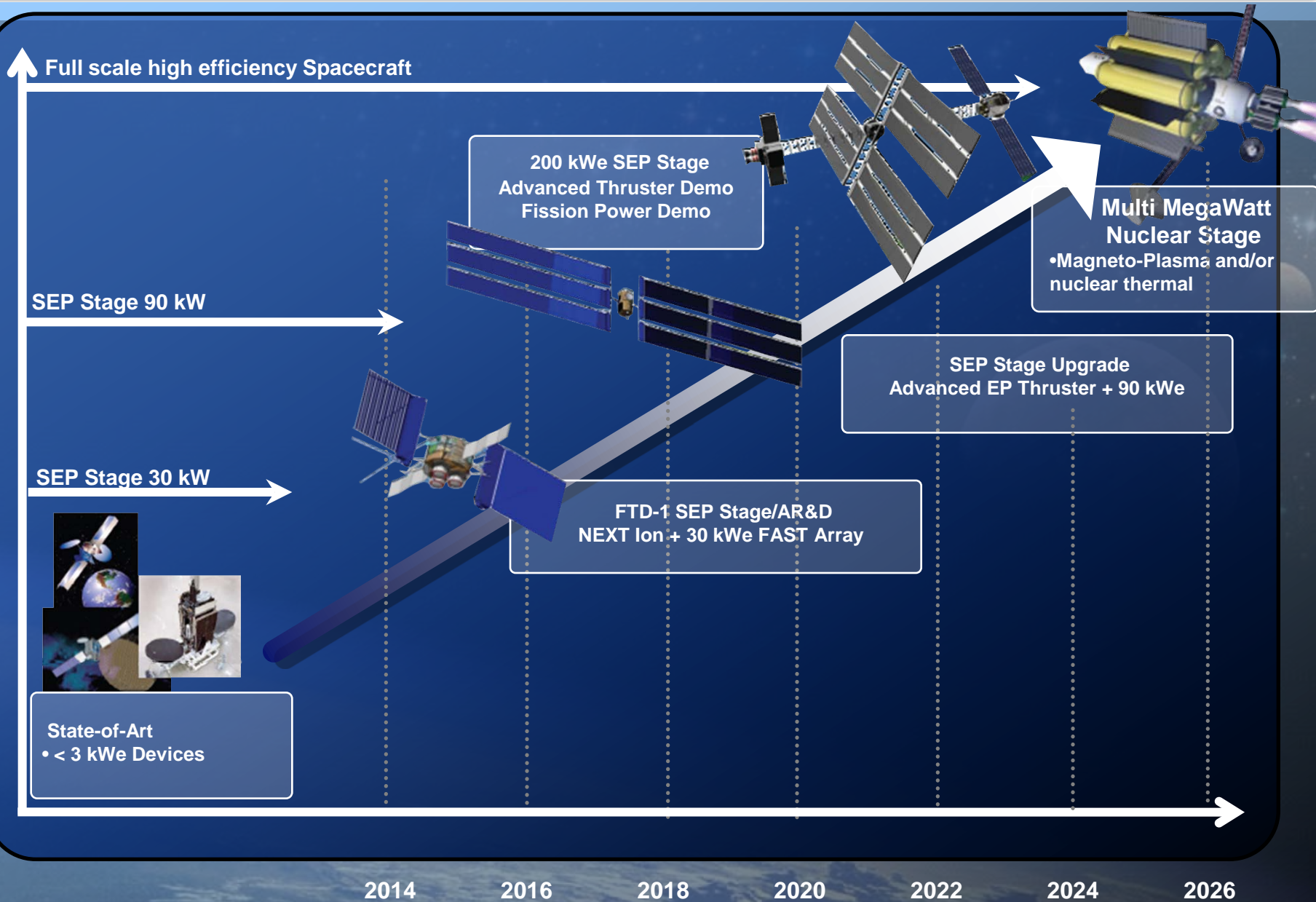
Key Technologies	SEP Mission*	Propellant Storage Mission*	Inflatable Mission*	AeroCapture EDL Mission
Propellant Transfer and Storage		x		
Lightweight/Inflatable Modules			x	x
AR&D	x	x	x	
Closed Loop Life Support			x	
Aero-capture and EDL				x
Advanced Space Propulsion	x			
* Flagship Service Vehicle is a common element needed across multiple FTD missions, but is not a separate mission	*	*	*	



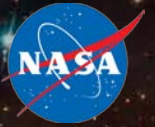
In Space Propulsion Technology Demonstrations (Preliminary)



Technology Demonstration Complexity and Available Power



In-Space Propellant Transfer & Storage Demonstrations (Preliminary)



Technology Maturation & Closure

- Long duration Cryo storage with Cryo coolers
- Cryo propellant transfer (inter-vehicular)
- High efficiency solar arrays
- Gas transfer
- Second generation quantity gauging
- Larger thrusters
- AR&D

- Six Month Cryo storage
- Cryo propellant transfer (intra-vehicular)
- First generation quantity gauging
- Automated Cryo coupling
- Small O_2/CH_4 thruster
- AR&D

2014

2015

2016

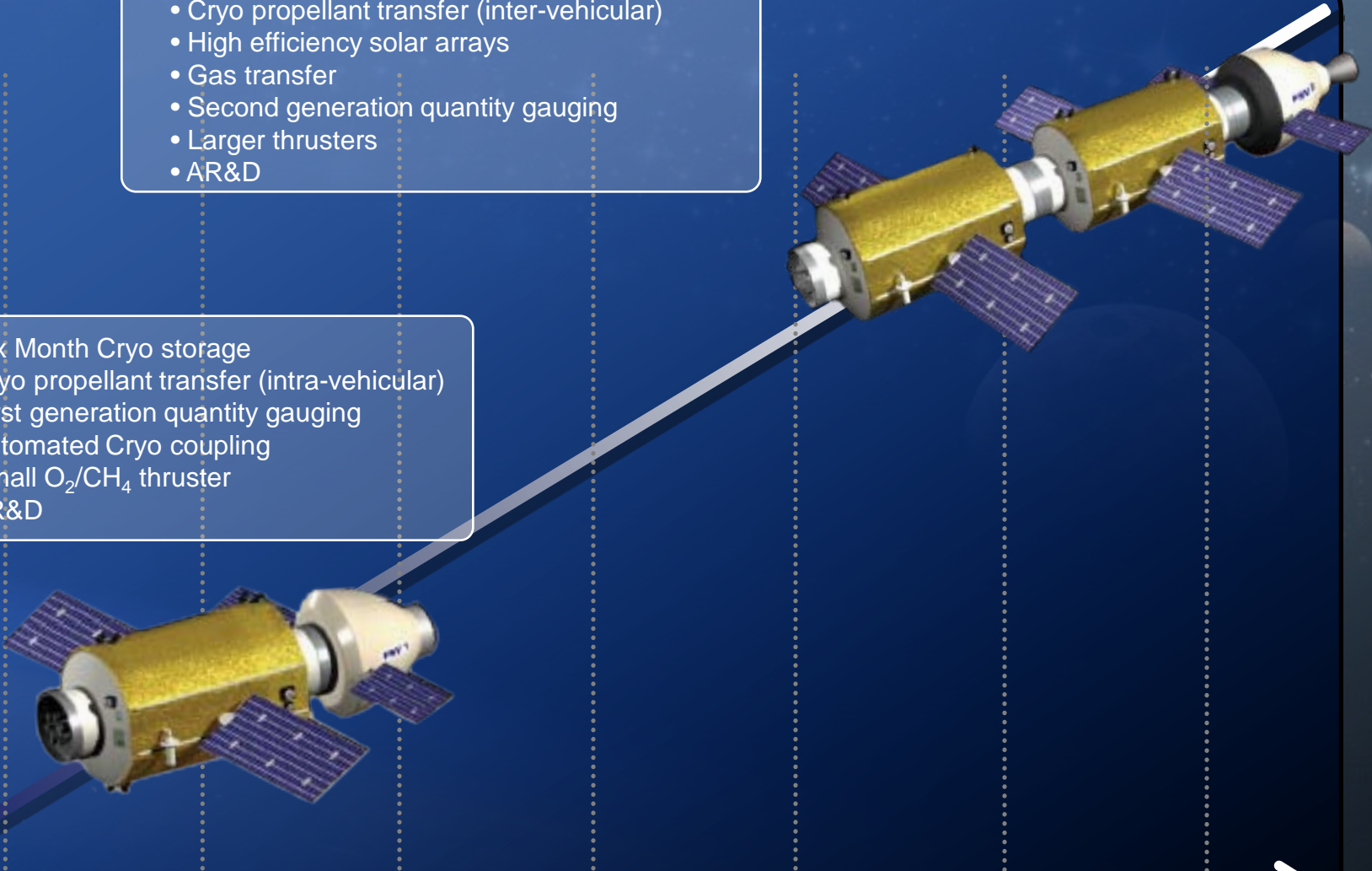
2017

2018

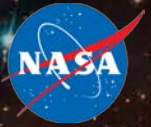
2019

2020

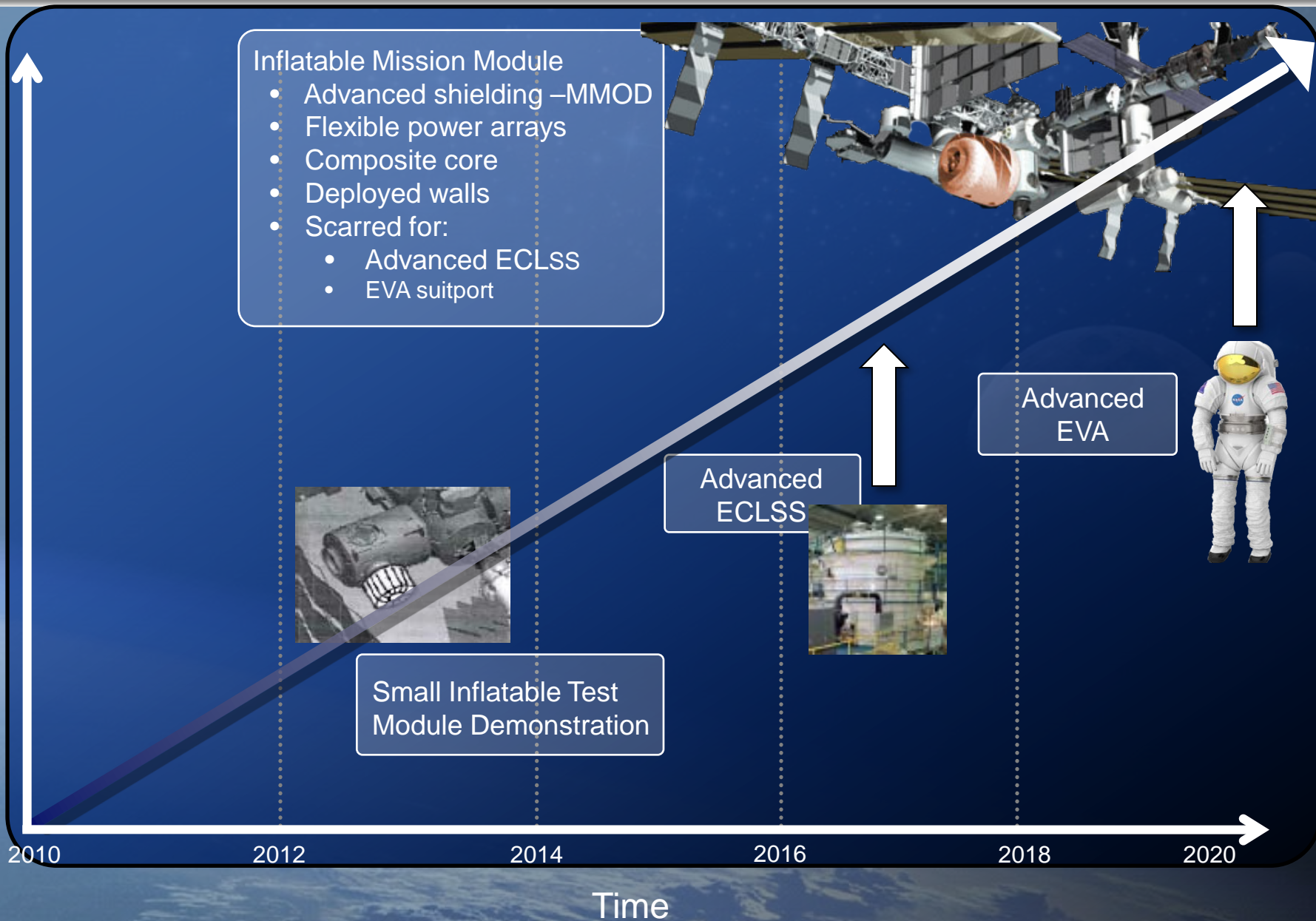
Time



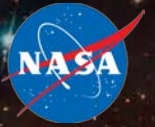
Inflatable Mission Module Capability Demonstrations (Preliminary)



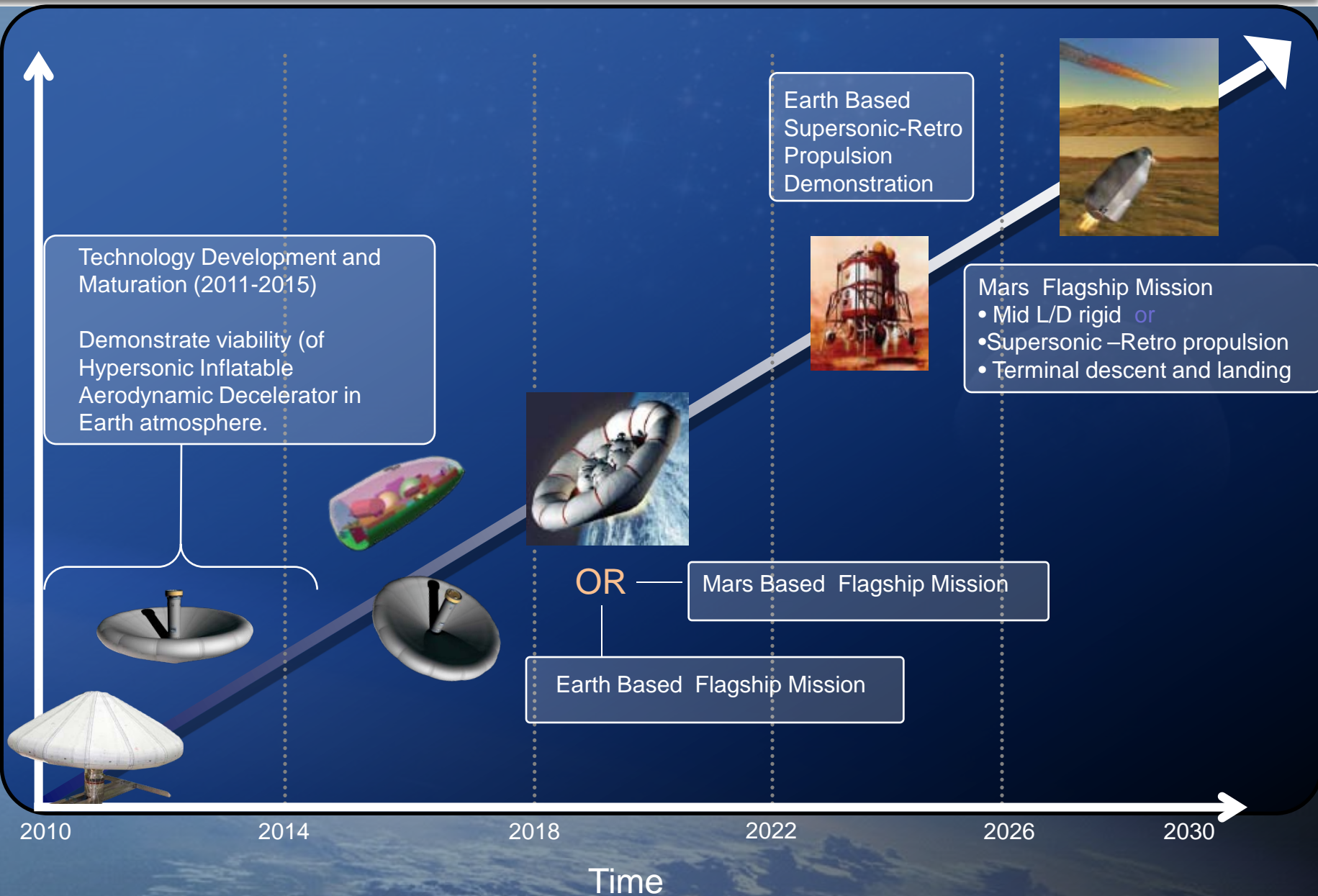
Technology Maturation and Closure



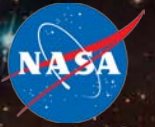
Aero Entry, Descent and Landing Capability Demonstrations (Preliminary)



Technology Maturation and Closure



ESMD: Blazing a Trail Into the Solar System



- NASA's human spaceflight program seeks to extend human presence throughout the solar system
- The President's FY2011 Budget Request takes a new approach to this goal, focusing on developing the capabilities that will allow us to reach multiple potential destinations, including the Moon, Asteroids, Lagrange points, and Mars and its environs
- The investments seek to create the new *knowledge* and *capabilities* required for humans to venture beyond low Earth orbit to stay
- Approach expands alternatives available for human exploration through timely strategic investments in essential technologies

